

MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George W. Cross

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FROM: Dennis K. Killian

DATE: October 13, 2003

SUBJECT: Properties of Coal that Influence NO_x Emissions

We recently acquired a paper from the International Energy Agency (IEA) Coal Research Center titled "How Coal Properties Influence Emissions" in an effort to explain our variations in NO_x emissions depending on the coal source. I have attached a copy of the section on NO_x for your review. Some of the more interesting items from the paper and our coal data are as follows:

- The paper does not mention any correlation between NO_x and Sulfur, even though our operating trends indicate a strong relationship.
- The main coal properties responsible for NO_x emissions are Nitrogen and percent Volatiles. Volatiles is usually expressed in terms of the Fuel Ratio (FR) which is defined as Fixed Carbon percent divided by the Volatiles percent. The higher the fuel ratio (inverse of volatiles) the higher the NO_x.
- Coincidentally, West Ridge Coal, our highest in sulfur, is also the highest in nitrogen and has the highest fuel ratio. The only fuel higher in nitrogen and fuel ratio was the pet coke/coal blend we burned as a test.

Nitrogen Content

While it is obvious that fuel bound nitrogen would have some effect on NO_x emissions, some plants have indicated variations of 60 percent or more while burning coal with comparable nitrogen levels. EPRI's earliest Coal Quality Impact Models (CQIM) used fuel bound nitrogen as the only coal variable. More recent models use different correlations. The following graph (Figure 1) shows the fuel bound nitrogen of the coals we have received in the last six months by source. Also included is the pet coke blend we burned during the second pet coke test for reference. Figure 2 shows anticipated NO_x levels based linearly on fuel bound nitrogen using 0.37 Lb/MBTU for the lowest nitrogen containing coal, SUFCO.

% Nitrogen (MAF)

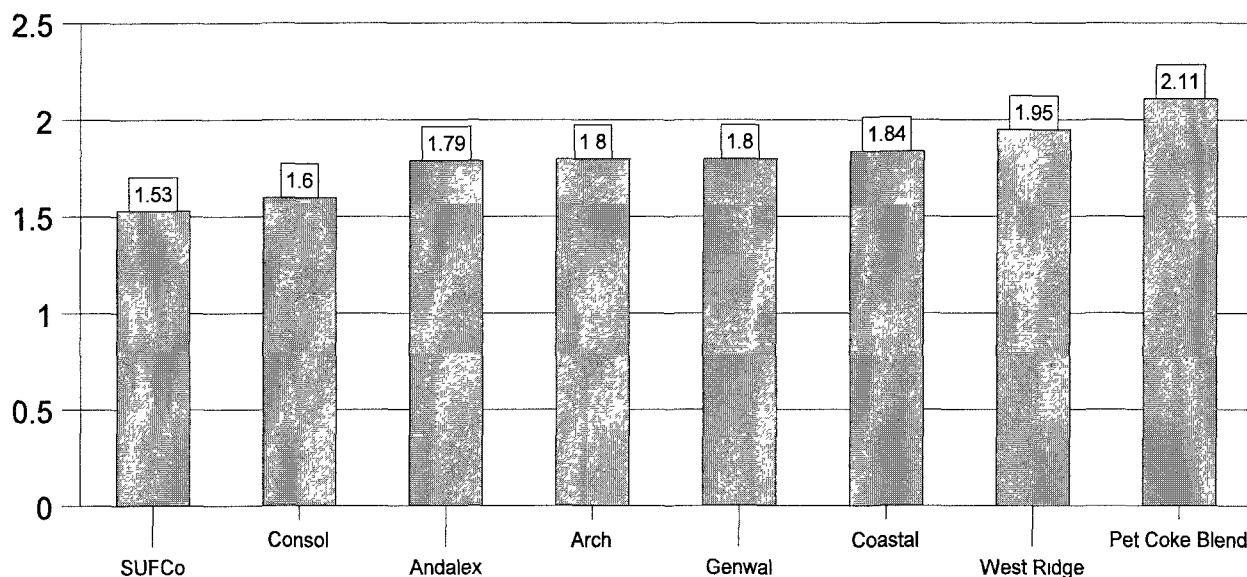


Figure 1

Predicted NOx (lbs/Mbtu)

Linearly Based on Fuel Bound Nitrogen, No OFA

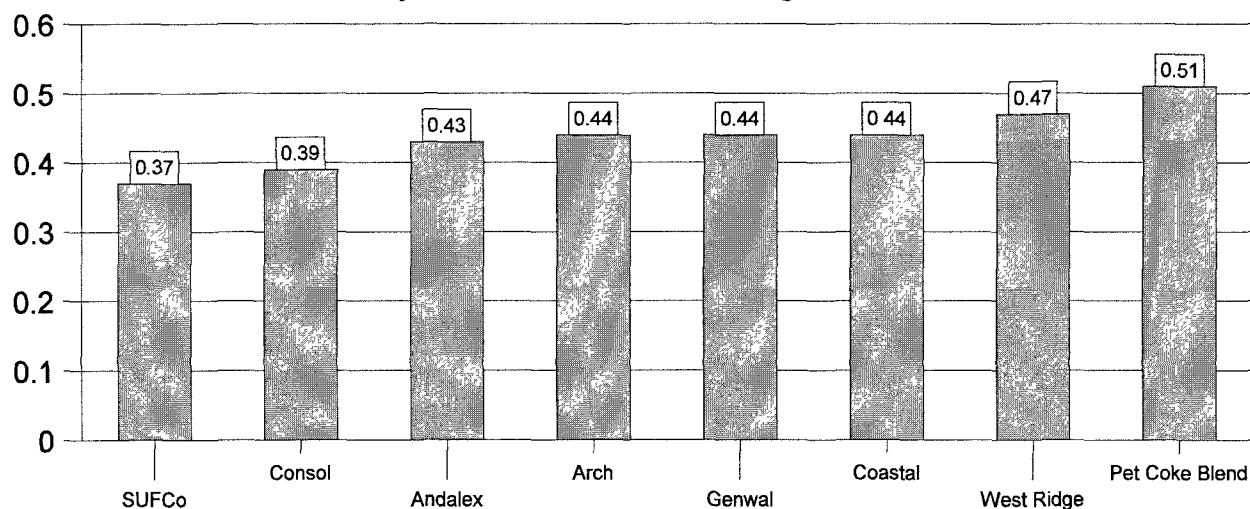


Figure 2

We have not done a lot of fuel source/NO_x correlations so it is hard to tell how well this or any method predicts our NO_x emissions for each fuel source. The only three coals we have good consistent data on are SUFCO, Westridge, and the pet coke/coal blend. This method appears to match Westridge fairly well but, it does not predict a high enough level for the pet coke/coal blend when NO_x was approximately 0.58 lbs/mbtu before operating changes were made.

Fuel Ratio

Fuel ratio is defined as the following:

$$\frac{\text{Fixed Carbon \%}}{\text{Volatiles \%}}$$

$$\text{Fixed Carbon \%} = 100\% - (\text{Ash \%} + \text{Moisture \%} + \text{Volatiles \%})$$

Fuel ratio was identified in IEA's report as the other main coal variable in NO_x emissions. They even go so far as to rank coal's NO_x generating capabilities on just fuel ratio with <1.5 for a "good quality" coal, 1.5 - 2.0 for an "average coal" and >2.5 for a "low quality coal". According to this scale, all of our current coal supplies would be in the "Good Quality" range as far as NO_x is concerned. The fuel ratio of the different coal supplies is shown in Figure 3.

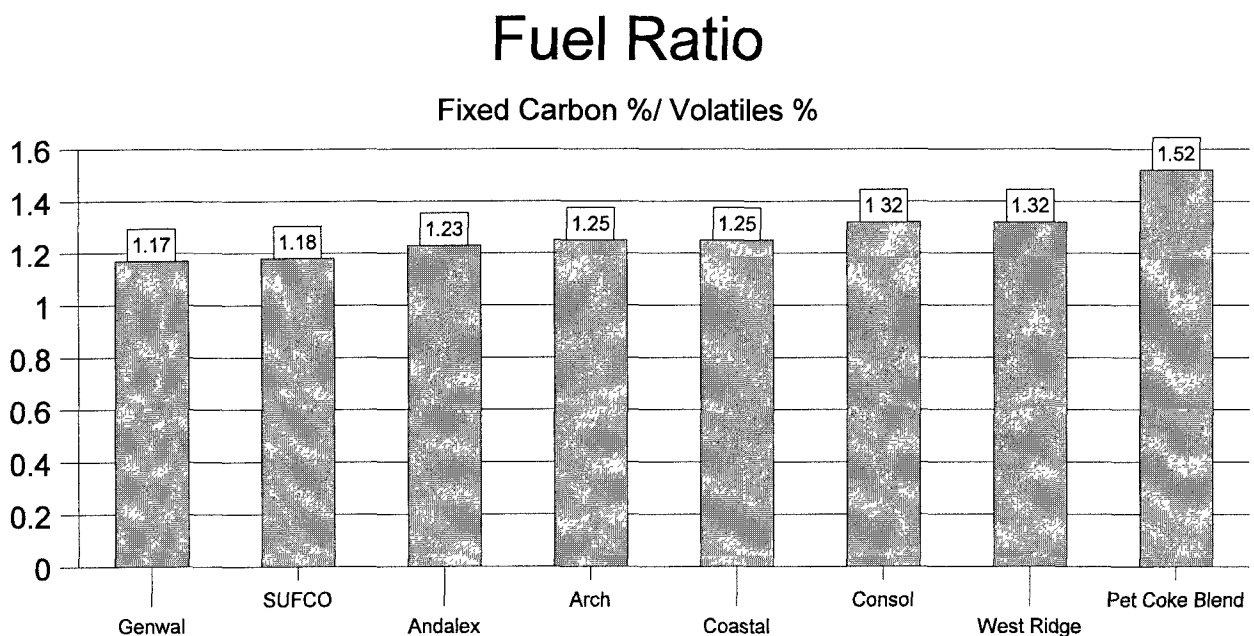


Figure 3

It is interesting to note that the effect of volatiles on NO_x emissions changes with the type of burners. With single stage burners, NO_x increases with increasing volatiles but, with low NO_x burners that stage the fuel and air, NO_x decreases with increased volatiles. This is explained by the fact that much of the fuel bound nitrogen is in the volatiles and low NO_x burners reduce NO_x by reducing the availability of air to the fuel during the initial stages of combustion when the volatiles are consumed. In fact, low NO_x burners only control the nitrogen in the volatiles and do little to reduce nitrogen formation during the char combustion process.

In 1999, studies of nine coals in a 70kW pilot combustor developed the following non-linear relationship of NO_x and the fuel ratio:

$$\text{NO}_x = a - b/x$$

x is the fuel ratio

a and b are positive coefficients based on the particular data set

Using 0.37lbs/mbtu for emissions with SUFCO coal and 0.47 lbs/mbtu for West Ridge coal and solving for two equations with two unknowns yields the following equation:

$$\text{NO}_x = 1.34 - 1.14/x$$

Figure 4 shows the results of this equation for our various coal supplies. Of course, the predictions for SUFCO and West Ridge were right on because the equation was developed around those results. However, it did do a good job predicting the coal/pet coke blend at 58 lbs/mbtu which was almost exactly what we saw before combustion changes.

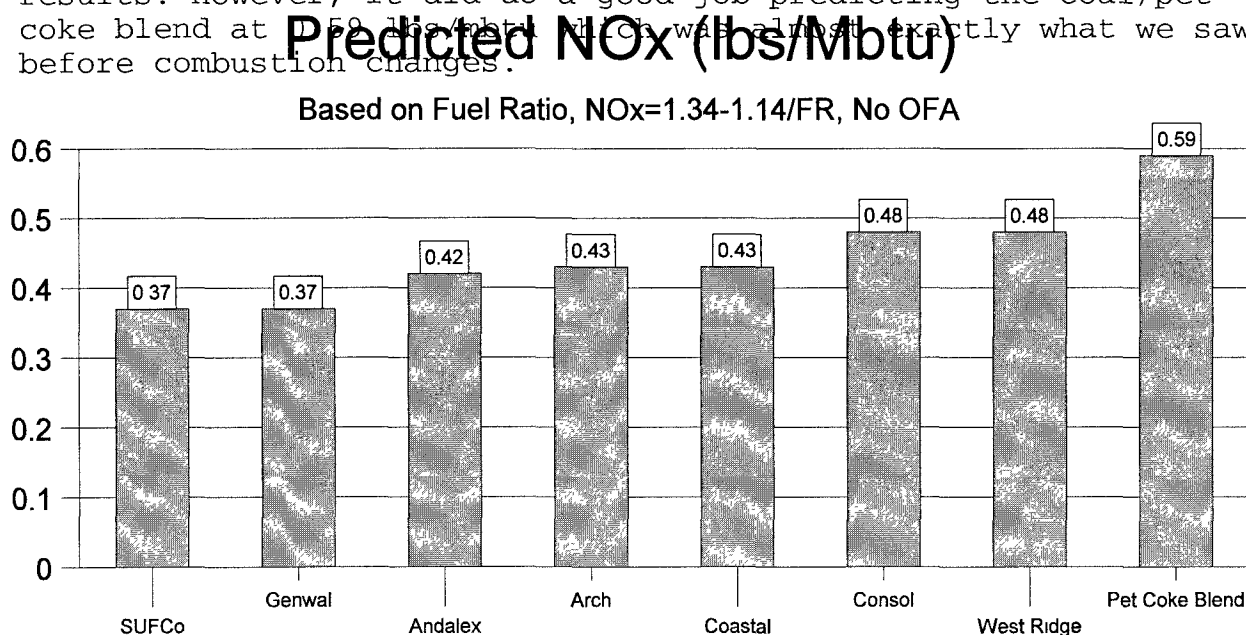


Figure 4

Summary

The installation of OFA has eliminated a lot of the concern we have had in the past about the effect of fuel on NO_x emissions. With OFA, we should be able to handle just about all of the coals we have used in the past but, it may still be difficult to burn straight West Ridge and we probably could still not do a coal/pet coke blend. If either of those are to be considered, more testing would be required.

If you have any questions please contact Jerry Hintze at ext. 6460.

JKH:jmg

Attachments

cc: Jon Finlinson
Joe Hamblin
Aaron Nissen
James Nelson

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: 6/28/01

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project. This meeting will be held the fourth Thursday of each month at 1:00 pm in Conference Room 4. The next meeting will be July 26, 2001

1. Project Status - Progress made during last month

Turbine Schedule - On or ahead of schedule so far

State Air Quality Review - What is status?

Cooling Tower Betterments - Engineering contract down to purchasing for bid

Scrubber Wall Ring - URS in the process of designing. Would like Sterling to fabricate and install. We are proceeding with assumption that it is okay to install without State approval.

HP Heater Drain Line - Decided to handle in-house instead of B&V.

2. Outside Engineering - Still working on getting contracts with Centry and Spectrum+Bennion. Centry has already indicated problems with manpower.

3. Current Status of Boiler Load Study by B&W

Preliminary results on heat transfer surfaces and flows

Hot and Cold Reheat Safety Valve Capacity

Recommending using ERV nozzles for new main steam safety valves

Should be able to achieve Nox objective of 0.3 with just burners, but LOI's will increase

4. Projects Required for 920MW (Spring 2002 Objective)

Required for 920 MW

Isophase Bus Duct Cooling

HP Dense Pack

HP Heaters Drain Modification

Moved to 2003, 950 MW

Transformer Modifications

Additional Generator Cooling

Large Motor Bus Equalization

Generator O2 Monitoring

Budgeted 2002, not needed 2003

Additional Safety Valves

Scrubber Wall Rings

Cooling Tower Make-up

6. Budgeting and schedule - Revised budget and schedule. We will modify project economics for next month to show effects of cash flows, load increase timing and revised cost estimates.

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: August 2, 2001

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project. This meeting will be held the fourth Thursday of each month at 1:00 pm in Conference Room 4. The next meeting will be August 30, 2001

1. - Fiscal Year 2001-2002 Projects Updates

Turbine Update - Discussion on new plan for installation

Scrubber Wall Ring - Received first set, Sterling Boiler is installing. Testing week of August 27.

Cooling Tower Make-Up - Starting design work, control philosophy discussion

HP Heaters Drain Line Modifications - Local engineering firms struggling with this project

Isophase Bus Duct Cooling - Purchase order for design issued

Additional Safety Valves - Will start after receipt of report from B&W. Any staff concerns with removing one of the Electromatics? How about removing both?

2. Cooling Tower Upgrade - Bids have been received, recommendation of award

3. Generator Cooling Study - Update by Jon Christensen

GE has finally agreed to do study. Discussion on latest information from GE on rewind cost and frequency.

4. Outside Engineering - Status of contracts and work packages.

Precision Engineering is taking exception to Professional Liability insurance requirement. Do we want to proceed with contract or just stay with Centry and Spectrum + Bennion? Spectrum + Bennion is currently preparing estimates for identified projects. Execution of contracts will be similar to others, we will solicit estimates and then send manual requisition for staff approval of each job.

5. Current Status of Boiler Load Study by B&W - Update by James Nelson

They may be recommending additional primary superheat tubes and other small modifications

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: August 30, 2001

1:00 PM, Conference Room 4

Purpose of the Meeting

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1. Cooling Tower Upgrade, Introduction of Bob Fleming, Marley CT. Status of project and review of scope of work. (Marley needs to leave for airport by 1:30 PM).
2. - Fiscal Year 2001-2002 Projects Updates
 - Turbine Update - Update
 - Scrubber Wall Ring - First set installed, testing week of September 17, 2001
 - HP Heaters Drain Line Modifications - Out for bid to outside engineers
 - Isophase Bus Duct Cooling - Out for design by vendor
3. Generator - Update by Jon Christensen, plans for upcoming outage.
4. Environmental, latest news from Rand and State. What does that mean for us?
5. Review of project economics

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: October 11, 2001

1:00 PM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project. This meeting will be held the fourth Thursday of each month at 1:00 pm in Conference Room 4.

1. Cooling Tower Upgrade, Status of study, limiting factor is circ water flow. Maximum without pump upgrade is 15%. 20% possible with pump upgrade. CT test results still not clear but, flow was much lower than acceptance performance test. Will have Marley estimates in time for budget.
2. Results of scrubber wall ring testing. Raw numbers look good but, some doubt remains because the numbers do not match the mechanism for improvement. We are recommending another round of testing ASAP before proceeding. Proposed "Minor Modification" from State DAQ will not require wall rings. Justification is now (2) pump operation.
3. Generator - Questions on proposed generator studies and plan?
4. Environmental, latest news from Rand and State
5. Update on Boiler Study by B&W, Just received written copy
6. Other Items

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: February 7, 2002

11:00 AM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project.

1. Review of Projects Scheduled for Completion this Year:
 - Additional Safety Valve
 - Isophase Bus Duct Cooling
 - 6A & 6B Heater Drains
 - CT Make-up Increase
2. Helper Cooling Tower Bid Evaluation and Project Schedule
 - Discussion on Fire Protection
 - Circ Water Pump Impellar Modifications
 - Preliminary Results of Soils Survey
3. Boiler Superheat Bundle Addition
4. Discussion on Unit Operation After this Years Outage
 - Maintain Steam Flow
 - Variable Pressure Operation
 - Starting and Loading
 - James is Writing an Information Sheet for the Operators
5. Discussion on Unit Operation After Next Years Outage
 - Approx. 6% Steam Flow Increase for 950 MW - Close to Current at Valves Wide Open
 - We Will Be Meeting Next Week To Discuss Plan for Nox Control
5. Other Items

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: June 13, 2002

1:00 PM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project.

1. Review of Project Economics
2. Boiler Concerns After Uprate
 - NOx Emissions - Fuel Appears to Biggest Factor
 - Overfire Air?
 - Steam Temperatures
 - Additional Superheat Surface
 - Fuel Input
 - PA Fan Capacity
 - Pulverizer Capacity
 - Pulverizer Rejects
3. Status of Helper Cooling Tower
 - Concrete Pipe Out for Bid
 - Circ Water Pump Impellers Out for Bid
 - Received Civil/Structural Drawings - Preparing Construction Contract
 - Rebuild Work for Existing Towers (Different Project)
4. Boiler Superheat Bundle Addition
 - Status of Contract
5. Discussion on Preliminary Results of Performance Testing
6. Presentation on Status and Plans for DCS Upgrade Project
 - Review Schedule
 - Status of Simulator Contract
 - Assistance from Outside A&E Firm
 - Status of Drawing Verification
7. Other Major Projects of Interest
 - GSB HVAC Upgrade
 - Replacement Condensing Units for Administration Building
 - ID Fan Drives - What Was Learned at Parish Station
 - Scrubber Reaction Tank Forced Air Oxidation

Here's the list:

1. Boiler temperature control
 - There was some feeling that maybe we should save the money and do nothing with the boiler and just run at some lower load.
2. Ability to reach new NOx limits and at what cost.
3. Problems with ID fan transformers overheating
4. General concerns over our ability, post uprate, to achieve the same kinds and levels of numbers we have achieved in the past. Felt that our reputation may be damaged.
5. A feeling that other, so far undiscovered, items would surface with more running time at 950 and that we would just be "nickeling and dimeing" our way out of these problems and that the total cost would be much higher than anticipated.
6. A feeling, from the last board meeting, that LA really doesn't want the extra power anyway (very short sighted)

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: June 13, 2002

1:00 PM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units.
To get instruction, direction and approval as needed for successful completion of the project.

1. Review of Project Economics
2. Boiler Concerns After Uprate
 - NOx Emissions - The Tale of Two Different Tests
 - Fuel Appears to Be Biggest Variable
 - What are our possible solutions?
 1. No Modifications for NOx, Run Close to The Annual Limit
 2. Run at reduced loads
 3. Overfire air
 - LOI's Will be Increasing No Matter Which Option We Choose
 - Steam Temperatures
 - Additional Superheat Surface
 - Fuel Input
 - PA Fan Capacity, High Speed Operation
 - Pulverizer Capacity and Reliability
 - Pulverizer Rejects
3. Baghouse, Scrubber and Draft Concerns
 - Baghouse DP
 - ID Fan Amps, Reliability and Redundancy
 - ID Fan Transformer Temperatures and Overloading, Scrubber HVAC
 - Water Balance
 - Sludge Conditioning
4. Turbine - Generator
 - Results of Performance Testing
 - Preliminary Alstom Report on Generator
5. Aux Electric System
 - Results of CEntry Load Study - No Easy Solution to Bus Loading Equalization
6. Status of Helper Cooling Tower
 - Pipe Has Been Awarded to Ameron
 - Construction is Out for Bid
7. FuelTech Presentation, Other Items

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: August 29, 2002

1:00 PM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project.

1. Update on Boiler Modifications

Awarded to Babcock-Borsig

Full over-fire air system with pendants

Third party model to verify their design

Permitting issues associated with over-fire air

2. Status of Helper Cooling Tower

Weyher has started work on the basin

Award of Tower Erection

Cooling tower parts are arriving

CEntry is working on the electrical design

May not be ready by end of outage but, will be ready when hot weather arrives

3. Plans to solve transformer overheating

4. Discussion on proposals for oxidizing air for the scrubber

4. Status of circ water make-up project

5. Plan and schedule for ID Fan Drive Replacement

6. Status of DCS Project

7. Other items

IGS UPRATE AND MAJOR PROJECTS - STAFF UPDATE

Meeting Agenda

Date: December 19, 2002

1:00 PM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project.

1. Scrubber Oxidizing Air Project - *James Nelson, Dean Wood*
Accelerated Schedule for Completion
Presentation by Black & Veatch
2. Update on Boiler Modifications - *James Nelson*
Moving cross braces
Variable Damper Controls
Status of Model by EER
R-Stamp Approval of Repairs
Outage Plans
3. ID Fan Drive Change-out - *James Nelson*
Status of Project
4. Transformer Cooling Enhancement - *James Nelson*
Change-out without Draining Transformer
Status of Proposals
5. Isophase Busduct Cooling - *Jerry Hintze*
Replacing duct from transformer just inside the building
Fan unit is on order
6. Status of Helper Cooling Tower - *Jerry Hintze*
Weyher's Progress
Unit 2 Tie-in during one week outage
Electrical Design and Construction Package
Circ Pump Impellers
7. Pulverizer Issues and Pulverizer Rejects System - *James Nelson*
8. Other items

IGS UPRATE AND MAJOR PROJECTS - STAFF UPDATE

Meeting Agenda

Date: February 18, 2003

10:00 AM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project.

1. Scrubber Oxidizing Air Project - *Dean Wood*
 - Status of design and completion by end of outage
 - Upcoming purchase requisitions
 - Venting system
 - Gypsum for Post-Outage Start-up
 - Results of dye testing and mixing model
2. Update on Boiler Modifications - *Phil Hailes, Ken Nielson, Aaron Nissen*
 - Status of installation
 - Status of control installation
 - Results of boiler model by EER - Aaron Nissen
3. Circulating Water Pipe Inspection - *Jerry Hintze*
 - What to plan for Unit 1 outage?
4. Transformer Work for Unit 1 Outage - *Pam Bahr, Jon Christensen, Jerry Hintze*
 - Status of Additional Cooling for Transformer
 - Status of Isophase Bus Duct Cooling
 - Meeting with Wasatch Electric
5. Status of Helper Cooling Tower - *Jerry Hintze*
 - Weyher's Progress
 - Unit 2 Tie-in
 - Electrical Design and Construction
6. Status of DSC upgrade - *Bill Morgan*
7. Status of Permit to Operate from State - *Rand Crafts, Blaine Ipson, Aaron Nissen*
 - Plan for pre- and post- outage testing
8. Other items

IGS UPRATE AND MAJOR PROJECTS - STAFF UPDATE

Meeting Agenda

Date: March 14, 2003

10:00 AM, Conference Room 4

Purpose of the Meeting

To update IPSC Staff on the progress, schedule and problems with uprating IGS units. To get instruction, direction and approval as needed for successful completion of the project.

1. Scrubber Oxidizing Air Project - *Bret Kent, Dean Wood*
 - Status of construction
 - Schedule for automatic defoamer equipment
 - Is it working? We will take samples next week to verify oxidation levels.
 - Sludge Conditioning, polymer will now work
 - Dredging project for next year, we need to stop inflow of materials
2. Over Fire System - *James Nelson, Aaron Nissen*
 - Preliminary results of testing
 - Where do we go from here?
 - Changes for Unit 2
3. Preliminary Results of Turbine Performance Testing - *Aaron Nissen*
3. Circulating Water Pipe Inspection - *Jerry Hintze*
 - Drawing showing number of broken wires
 - Experience of other utilities learned at Tucson Conference, failure mode
 - Proposal from Engineering firm to evaluate our pipe
4. Status of Helper Cooling Tower - *Jerry Hintze, Mike Nuttall*
 - Weyher is essentially complete, doing extra work for us and gone in a week
 - Electrical construction (GSL) is making progress
 - Delivery of transformer is critical path at this point
 - Start-up testing and commissioning
6. Status of DSC upgrade - *Bill Morgan*
 - Bids being evaluated
 - Schedule for award
 - Status of simulator contract
7. Major Capital Projects Scheduled for Next Year - *Jerry Hintze*
 - Starting on specification for new burners
 - Preparing specification for air heater baskets
 - ID Fan Drive Replacement
 - Scrubber Electrical Room Cooling
8. Supplemental Maintenance Contract - *James Nelson*
 - Changes from last contract
 - Justification for contract amount
9. Other items

Agenda
NOX Control After Uprate Meeting
February 14, 2002, 1:00 PM
Conference Room 1

1. What are our new NOx Constraints? How much wiggle room will we have? What will happen if we do not meet them? What will this mean for the new limits proposed for 2007? (Rand Crafts)
2. Discussion on where we will have to run to remain in compliance
3. Review on what happened during the pet coke test burn on Nox reduction
4. Discussion on possible methods for Nox control.
5. Discussion on possible testing to verify some proposed methods.
6. Other items and next meeting

Status of Unit 1 Upgrade

HP Turbine Section: The casting of all the major components has been completed and is currently being machined. Alstom may be making some minor adjustments to the design to reduce the maximum steam flow capacity by a very small margin. We are having discussions with them now to decide that for sure. The new HP section for Unit 1 is expected to be delivered on-schedule.

Helper Cooling Tower: Parts for the helper cooling tower should start arriving in early September. The design for the supporting basin and buildings has been completed by CEntry Engineers out of Salt Lake City and the construction contract will be awarded to Weyher Construction out of Salt Lake City. Weyher did about \$30,000,000 worth of work during initial construction of the plant. Weyher should be on the job site by mid-August and will start pouring concrete in September. The helper cooling tower should be completely installed and functioning by the end of the Unit 1 outage next spring and is projected to be slightly under budget.

Boiler Modifications: The contract for the necessary boiler modifications for the uprate is currently out for bid with bids due back in about two weeks. The boiler modifications are planned to consist of additional tube length for secondary superheat pendants and a partial overfire air system. It was decided to install a partial overfire air system after some operational testing at 950 MW on Unit 2 this spring. The testing showed that reducing excess air to lower NOx had an adverse effect on main steam temperatures and discussions with the boiler manufacturers indicated that a partial overfire air system could be installed for much less than originally anticipated. All of these modifications will be installed for the amount originally budgeted for additional primary superheat surface alone. As a point of interest, the boiler will be completely scaffolded internally to complete these modifications. This will be a first for IGS.

IGS UPRATE PROJECT STAFF UPDATE

Meeting Agenda

Date: 4/16/01

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1. Assignment of Identified Projects

Project

- HP Turbine Retrofit
- Boiler Safety Valve Addition
- Generator Cooling Enhancements
- Large Motor Bus Loading Equalization
- Cooling Tower Performance Upgrade
- Isophase Cooling Enhancements
- Boiler Feed Pump Performance Upgrade
- Main Transformer Cooling
- NOx Reduction Project
- Scrubber Wall Ring
- Generator SCW O2 Monitoring
- HP Heater Drain Line Mods
- Boiler Modifications
- Cooling Tower Makeup Mods
- Cooling Tower Electrical Redundancy
- PA Fan Motor

Project Engineers

Phong Do/James Nelson
Dean Wood/Craig Stumph
Phong Do/Jon Christensen
Pam Bahr
Aaron Nissen
Jon Christensen
Dave Spence
Jon Christensen
Jerry Hintze/James Nelson
John Howard
Jon Christensen
Dean Wood
Craig Stumph/James Nelson
Pam Bahr
Pam Bahr
Jon Christensen

2. Completion Schedule of Projects

3. Budgeting of Projects

Budgeted for 2001-2002

HP Turbine Retrofit
Boiler Safety Valves Enhancements
Increase Circ Water Make-Up Flow
Scrubber Wall Rings

Not Budgeted But Needed in 2001-2002

Isophase Bus Duct Cooling
Generator Cooling Increase
Large Motor Bus Equalization
Main Transformer Cooling
Generator SCW O2 Monitoring
HP Heater Drain Line Modifications

4. Discussion on Generator Capacity

5. Discussion on Cooling Tower Modifications

6. Other Items

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HP Heater Drain Line - Decided to handle in-house instead of B&V.

2. Outside Engineering - Still working on getting contracts with Centry and Spectrum+Bennion. Centry has already indicated problems with manpower.

3. Current Status of Boiler Load Study by B&W

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4. Projects Required for 920MW (Spring 2002 Objective)

Required for 920 MW

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HP Dense Pack

HP Heaters Drain Modification

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Transformer Modifications

Additional Generator Cooling

Large Motor Bus Equalization

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Budgeted 2002, not needed 2003

Additional Safety Valves

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Cooling Tower Make-up

6. Budgeting and schedule - Revised budget and schedule. We will modify project economics for next month to show effects of cash flows, load increase timing and revised cost estimates.

Significant Items for Eric Tharpe - June 2004

1. AWARE Software for Boiler Maintenance and Failure Tracking:

We received the new software that we purchased for tracking and reporting boiler tube leaks and repairs. The software is called "AWARE" and has been installed at numerous utilities around the world and is used by Alstom's boiler field service engineers. AWARE Software provides IPSC with a tool to manage data and analysis related to tube failures, inspections, UT readings, etc. This will allow us to better predict areas requiring maintenance or replacement and to focus our resources where it can provide the most benefit.

We received training from ATI, the software designer, on how to convert our existing boiler maintenance database to the new AWARE system and we are in the process of doing that conversion as well as loading new data into the system.

2. Unit 2 Combustion Testing for State Verification of CO and NOx Emissions:

We completed and the State witnessed testing to verify that Unit 2 CO and NOx emissions are similar to the data previously submitted for Unit 1. The purpose of the testing was to demonstrate to the State DAQ that the NOx limits required can be achieved without excessive CO emissions, particularly with the over fire air system in-service. Testing on Unit 1 completed last year showed that the over fire air system could be operated successfully and this testing was trying to show that Unit 2 was operating similarly. Testing without over fire air and with up to 10% overfire air was successful, however; at 14% over fire air, CO increased above acceptable limits and further balancing is required to reduce CO. More testing will be done in July.

3. DCS Project Update:

We continued to make progress on correcting the identified deficiencies on the Unit 2 new information computer system from ABB. Some redundancy issues and alarming still remain but, will be corrected prior to implementation on Unit 1 next spring. Another factory acceptance test on the control logic was also completed at the ABB offices in Wicksville, Ohio. The control logic needs to be debugged before it can be sent to the modeling company for implementation into the plant simulator that will be used to train the Operators on the new system.

Significant Items for June 2005

Training on Simulator for New DCS System - Training was completed during June on the new simulator that will be used for training the Operators and Technicians on the DCS system that will be installed on Unit 2 next spring. The training was conducted by ESSCOR, the contractor on the simulator project and it was given to the Training Instructors and the Model Development Team. They also completed some deficiencies that were found during and prior to the training.

Fire on Unit 2 F3 Burner - A fire occurred on Unit 2, F3 burner that destroyed the inner barrel and coal nozzle and required that the burner be removed from service. The fire was not detected by Operations because the fire detector temperature switches had been destroyed. We installed new alarms for all of the Unit 2 burners into the DCS using existing thermocouples.

Soil Analysis for Cathodic Protection System and Evaluation of Condenser Cathodic Protection Systems - A contractor (CORRPRO) was on-site taking soil samples for the design of a cathodic protection system for the circulating water lines. They collected samples for analysis from various locations along both units pipelines. They also evaluated the operation of the cathodic protection systems for the condensers on both units.

Significant Items for June for Eric Tharpe

June Unit 1 Outage to Repair Turbine Control Valve #2 Seat

During the last week of June, Unit 1 was removed from service for approximately six days to repair the seat on Turbine Control Valve #2. Several days before the outage, during the weekly routine valve test, it was noticed that Valve #2 would not go fully closed. The controls were checked and it was determined that the problem was coming from inside the valve itself. Concerns over foreign material going through the turbine initiated the outage to disassemble the valve for inspection. When the valve was opened, we found the seat had raised in the body over one inch and the retaining pins at the bottom of the seat had broken off.

The seat is supposed to have an interference fit in the body but, was loose and easily removed. It appears that the seat was installed incorrectly during initial construction, IPSC has never replaced this seat. We had to wait for the valve to cool before reassembly work could begin for safety reasons.

Recommendation to award new DCS contract to ABB

The bid evaluation for the new Distributed Control System (DCS) was completed and we are awarding the contract to Asea Brown Boveri (ABB) with their home office in Wickliffe, Ohio. ABB was determined to be the best value with the least amount of risk based on their bid (second lowest) price and past history of performance. ABB has a proven track record of completing their projects on budget and in the allotted outage time frame.

Completion of the annual coal stock pile inventory

The annual coal stock pile inventory was completed as it is every year during the month of June. The coal stock pile inventory consists of three separate parts; an aerial survey, a ground survey and a coal pile density survey. Results from all three different surveys are used to calculate the current inventory of coal on the ground. That number is then compared to the number calculated from the burn and delivery rates throughout the last fiscal year and an adjustment is made to reconcile the two inventories. *(Ann, if you wait until 7/2 I can give you some preliminary results to include).*

Boiler testing to determine CO emissions with overfire air

Testing was done on the Unit 1 boiler to accomplish three separate goals. The first goal was to tune the boiler for the best NOx reduction with the lowest Carbon Monoxide (CO) emissions. The second is to demonstrate to the State of Utah Division of Air Quality that CO emissions from the boiler will be within the limits we have agreed upon. The third is to verify the CO and NOx emissions levels guaranteed in the contract with Babcock Power Incorporated (BPI). Testing showed that we were able to meet the limits specified

by the State but, we are not satisfied with the level of excess air required to meet the limit and we intend to do further tuning and balancing on the burners with both fuel and air to try and lower the CO emissions even further. We need to get the CO as low as possible to give us the operating flexibility for maximizing NOx reduction. We have not yet achieved the level of CO emissions specified in the BPI contract and they are going to assist us that goal during the next round of testing.

Water Companies' Grant for Work on Sevier Bridge Reservoir

The Utah Division of Water Resources Board approved a grant for \$4.29 million for repairs and upgrades on the dam at Sevier Bridge Reservoir. This reservoir is owned by the five DMADC irrigation companies, of which IPA is a shareholder in each company. The required repairs and upgrades include flattening and stabilizing the upstream face of dam, constructing a new guard gate structure, constructing a new control building, installing hydraulic controls for the new guard gate, etc. The present plan is to begin construction on August 15th, and close the gates to the reservoir on October 1. There will still be remaining work after October 1, but it will all be above the water level.

Toxic Release Inventory (TRI)

The TRI for the previous calendar year is required to be submitted to the EPA every year by the end of June. IPSC submits a copy to the State of Utah, LADWP submits the original to the EPA. This is a report that details the amounts of certain chemicals which have been "released" to the environment. The bulk of the chemicals that are emitted from IPP come from burning coal for energy. Trace amounts of TRI chemicals are found naturally in the coal, and the become part of the ash leftover after the coal is burned. Even though these chemicals are found at very low concentrations, they still add up from the millions of tons of coal burned each year.

More than 88% of IPP's TRI releases are tied up in the ash it disposes of in its landfill. The ash is mixed with sludge from the scrubbers. The ash and sludge mixture forms a cement-like compound, minimizing the chance that any chemicals will leach from the landfills. EPA has determined that ash from power plants is not hazardous. In fact, the ash is safe enough to use in concrete and other construction materials. EPA has in the past indicated that emissions from power plants, while high in volume, are generally low in risks to public health.

IPSC Power Plant Simulator

The simulator contract was awarded to Esscor of San Diego, California. The project kickoff will be July 8th and the simulator is scheduled to be finished in December 2004. The simulator is part of the DCS upgrade project and will allow the DCS controls to be tested on the simulator before they are implemented on the plant in March 2006. The simulator will run the same control software that will run on the new DCS. Esscor will soon start building the model, and the ABB the DCS vendor will start building the

controls and graphics package. IPSC personnel will draw the DCS graphics with direction from ABB. The system will also be a training tool and will be available for training one year before the 2006 Unit 2 startup.

January 2004 Significant Items for Eric Tharpe

1. Start of Unit 2 Outage Construction Projects: Construction work started for the modifications that will be completed on Unit 2 during the upcoming outage. This will be the largest amount of construction activity at the plant since initial operation. The major projects started in January are as follows:

New Digital Control System: Capital Electric, the construction contractor for ABB, arrived on site and began running cables and receiving equipment for replacement of the Unit 2 information computer.

Overfire Air and New Burners: TEI Construction company began modifying the boiler structure and platforms to allow for installation of the new over fire air system similar to that completed on Unit 1 last year. TEI also received the first shipments of new burners that they will install.

Air Heater Baskets: TEI Construction will also be installing new baskets in the Unit 2 secondary air heaters. They received the new baskets in January and started staging them for installation.

New Turbine Vibration Monitoring Equipment: Bently Nevada came on-site for awhile during the month to finalize the cable routing and equipment mounting locations for the new vibration monitoring system they will install during the outage.

New ID Fan Drives: Alstom came on-site to complete the final arrangements for installation of one new ID Fan variable speed drive. A quality control visit was also made to the Alstom fabrication facility.

2. Changing Coal Quality: During the first part of January, we saw an approximate 40% increase in the amount of sulfur in the coal burned on both units. Previously, we had tried to maintain the total tons of SO₂ emissions per month equivalent to that prior to the unit load increases. This was done to insure that the up-rate project remained under the requirements of the WEPCO rule. With the increase in coal sulfur, it was impossible to achieve that without making some allowance for coal quality which the WEPCO rule allows. Using data from before and after the up-rate on both units, curves were developed that gave mathematical relationships for scrubber removal as a function of SO₂ inlet that can be used to account for coal quality. The curves were also used to give the Scrubber Operator's a hard target for instantaneous emissions that they must work to maintain.

3. Scrubber Forced Oxidation: The first of the oxidizing air blowers from Atlas-Copco were received and partially installed on Unit 1. The remaining blowers should arrive in February. We are planning to have one blower operating in Unit 1 by the end of February.

Unit 1 In-Service with New HP Turbine and Overfire Air

Unit 1 was returned to service following the major outage in March with the modifications in place to allow operation at 950 Mwg. Based on experience from last year, we expected some difficulties balancing the turbine following the installation of the new HP section and we were not disappointed. The turbine rolled up cold better than last year but, vibration levels continued to climb and several balance shots were needed to get it into acceptable ranges. The overfire air system to control boiler NOx emissions was placed into service for the first time and it appears to be lowering emissions around 10% compared to Unit 2. Testing scheduled for May will quantify the exact improvement.

Scrubber Oxidation Air System In-Place on Unit 2 with Temporary Air

The high sulphur content of Westridge coal has made it necessary for us to install oxidizing air in the scrubber reaction tanks to complete the chemical conversion to calcium sulfate. During the Unit 1 outage, the piping for the oxidizing air system was installed on four modules and it was temporarily connected to the spare fly ash compressor. The fly ash compressor will supply the air for oxidation until the new compressors can be received and installed. The fly ash compressors only have about half of the needed capacity for full oxidation but, it is enough to keep the scrubber liquor chemistry out of a scaling regime. This modification will allow us to start burning Westridge coal on Unit 1. We are currently working on installing the same system in Unit 2 as modules are available and that system should be in-service sometime this summer.

Forced Outages in April from Boiler Water Wall Tube Leaks

On April 5, Unit 1 was removed from service to remove the start-up screens on the HP turbine and to install additional balance. We have since had two other outages to repair boiler water wall tube leaks. On April 13, Unit was removed from service to repair a water wall leak on the boiler west wall near the intersection with boiler slope floor. The leak was on the outside of the boiler but, under a structural support plate. A window was cut in the plate and the crack ground out and repaired. During the same outage, additional balance shots were placed in the turbine. Unfortunately, shortly after returning to service, a leak was detected in the same area (but not the same crack) and the unit was removed from service on April 26 to repair this leak. This time the structural plate was completely removed and a thorough inspection was done. Six additional cracks were found in the same area and they were ground out and repaired. The cracks appear to be caused by stresses from a structural connection of the sloped wall support on the opposite side from the leak. We are reviewing the design of the support with B&W.